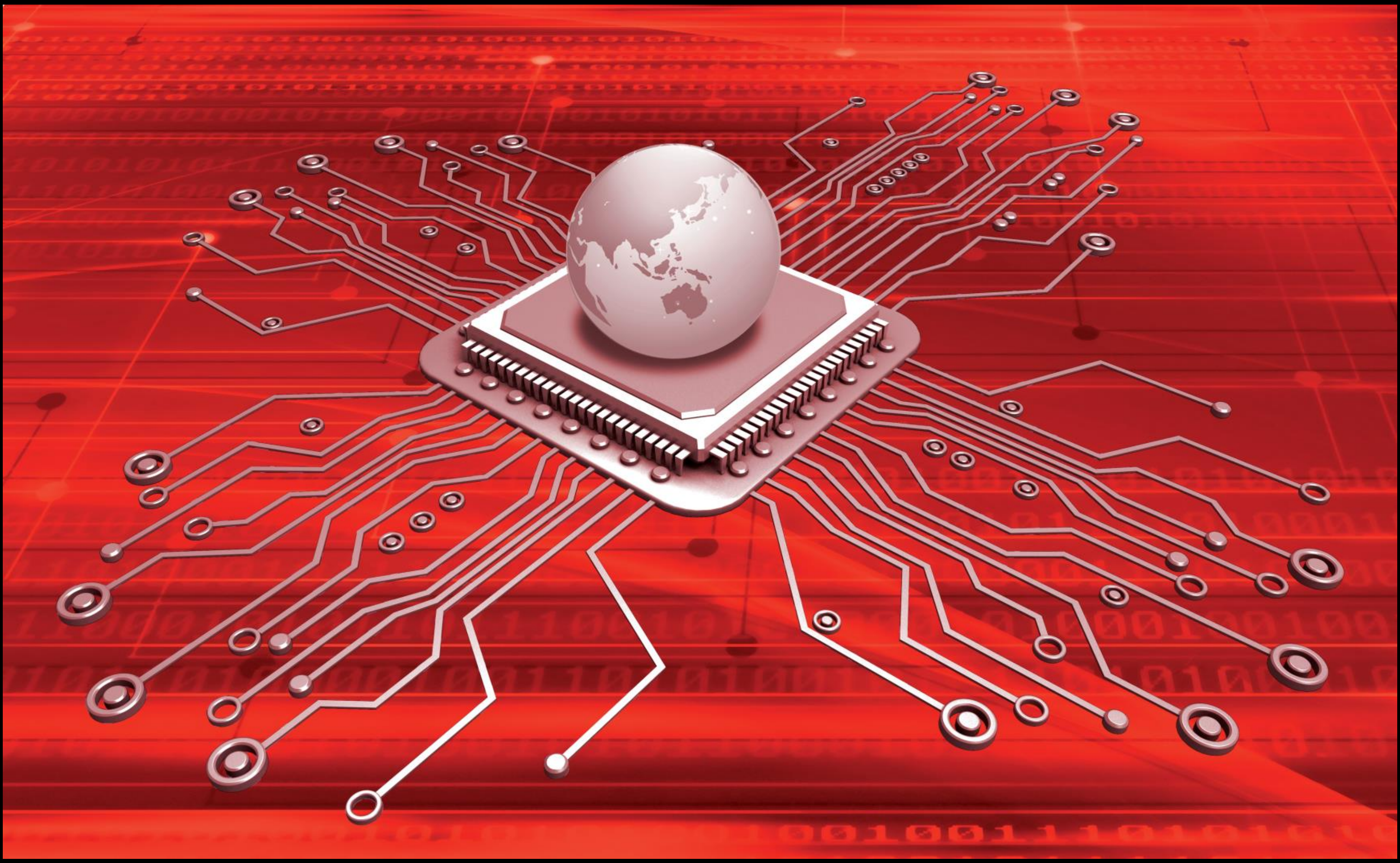
SemiHow SUPER JUNCTION MOSFET Selection Guide



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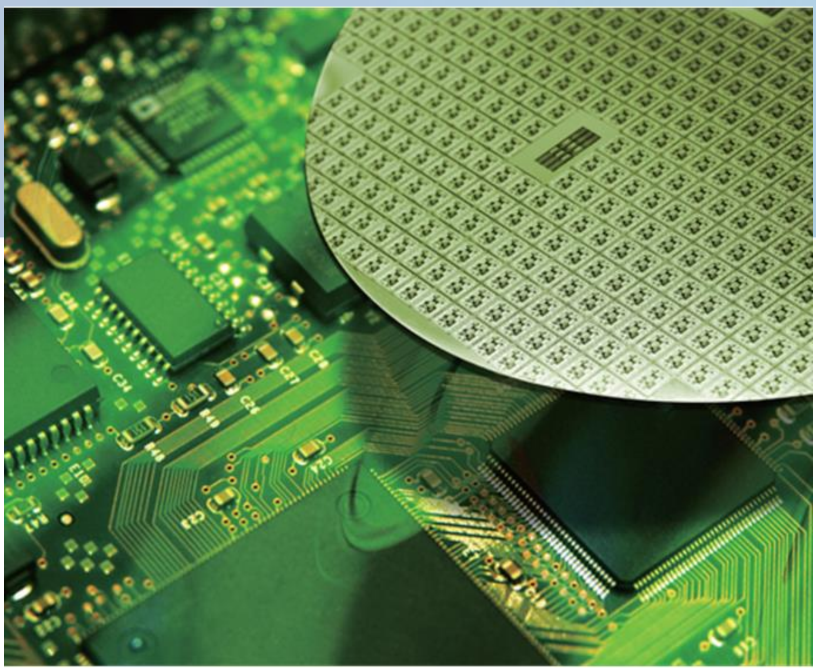


SemiHow SUPER JUNCTION MOSFET

Super Junction MOSFET of SemiHow ("SJ MOSFET" hereinafter) uses SemiHow's own cutting-edge technology for LED lighting and Consumer application.

SJ MOSFET shows better efficiency, thermal management and cost-efficiency in comparison with Planar MOSFET.

We're trying to do our best to offer support for various inquiries from customers such as short lead time, technical support and so on.

SEMIHOW SJ MOSFET

Voltage range

500 V	600 V	650 V	700V	800 V

RDS(ON) RANGE

500 V	600 V	650 V	700V	800 V
0.15Ω ~ 0.4Ω	40mΩ ~2.3Ω	40mΩ ~2.3Ω	0.13Ω ~ 1.6Ω	0.24Ω ~ 1.3Ω

Power supply topology and market segment

- Adapter/charger/Quasi-resonant flyback
- PC power PFC/TTF, PFC/LLC
- LCD TV / LLC half-bridge
- LCD TV adapter / Quasi-resonant flyback
- LED drivers, PFC/LLC Non-isolated bulk
- LED drivers / Quasi-resonant flyback

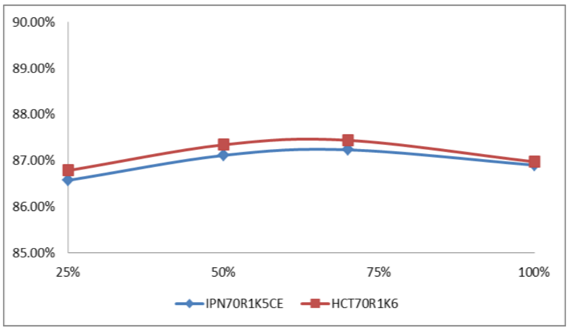
Benefit

Various line-up	500 ~ 800V / SOT-223 ~ TO-247
Capacity of production	Running designated FAB and PKG line for stable supply of product
Lead time	Managing delivery efficiently (e.g. Intermediate amount : within 8 weeks)
Quality	Managing defective rate below 0.1 ppm
Circuit design	Full-time support by SemiHow's FAE

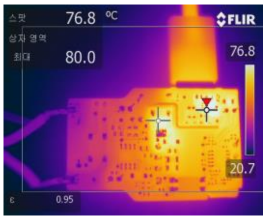
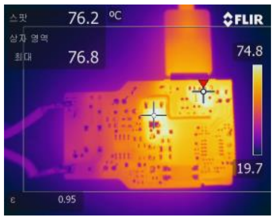
Smartphone & Tablet chargers

Charger for Smartphone, Tablet PC requires maximum output power from smaller size. For this reason, strict requirement regarding system cost are needed according to increasing power density, managing heating, emitting EMI and etc.. Most of OEM companies requires the temperature of case below 50℃ and MOSFET below 90℃.

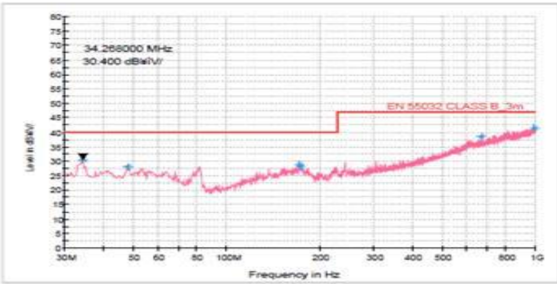
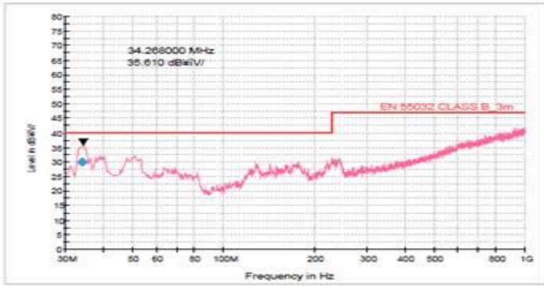
1. Feature test of HCT70R1K5E (15W Quick charger for GALAXY S9)



[Efficiency]

	IPN70R1K5CE	HCT70R1K6
264Vac		
	Max 76.8	Max 76.2

[Temperature]

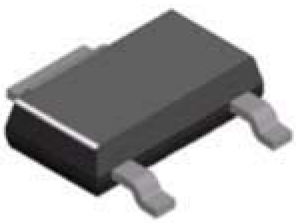
	SemiHow	INFINEON
시료1		

[EMI - RE]

2. ESD Evaluation

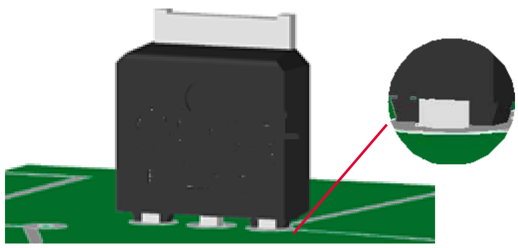
Device	HCT70R1K6 (New of DB)	HCT70R1K5E (Trench)	infineon 70R1K4CE	UTC 5NM70
ESD (HBM)	<3000V	< 800V	< 800V	< 800V
Class	CLASS 2	CLASS 1B	CLASS 1B	CLASS 1B

3. SemiHow PKG for Charger NOTE



SOT-223

Optimized PKG for Minimum space



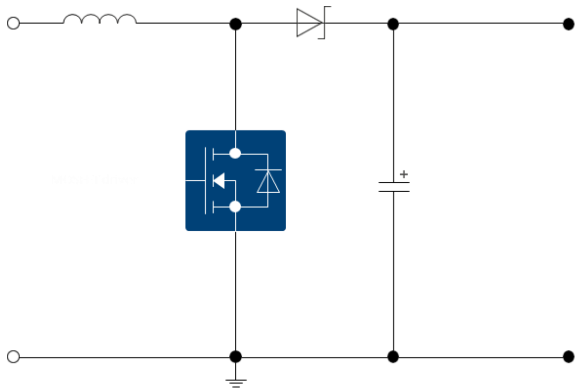
TO-251B (Short Lead with Isolation)

- **Can enhance productivity of customers through including Mold Stopper for protecting from leakage current based on wafer level and contaminants**
- **Mold Bumps of 0.3mm are ideal for maintaining a well-defined distance between the PCB and the package body and a larger effective distance on insulating**

APPLICATION

• Single switch topologies – Boost / PFC

High power adaptors, PC power, TV power supplies of front-end



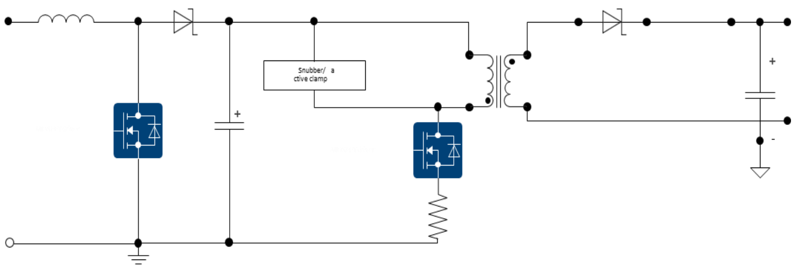
Design equations for MOSFET selection
$V_{DS} = V_{out}$
$I_D = I_{out} * 1 / (1\text{-}D)$
$V_{DS\_FET} = 1.5 * V_{DS}$ (with derating for all variables on board)
$R_{DS(on)}$ max. 25°C for acceptable power dissipation in MOSFET package $= (1.5 * P_{device}) / (I_{pk}^2 * D)$. I_{pk} is derated value of I_D to cover all worst case operation conditions. $I_{pk} = 1.5 * I_D$
$P_{device} = (T_j - T_a) / R_{thJA}$

Output power [W]	Input voltage [V]	PFC output load current at 400 V output voltage [A]	SEMIHOW Device
200	85 V_{AC}…265 V_{AC}	0.6	HCx60R350T*/HCx60R380*
150	85 V_{AC}…265 V_{AC}	0.4	HCx60R380
100	85 V_{AC}…265 V_{AC}	0.3	HCx60R520T
75	85 V_{AC}…265 V_{AC}	0.2	HCx60R700T

*Two in parallel

• Quasi-resonant flyback topologies

Chargers, Adaptors, Auxiliary power supplies



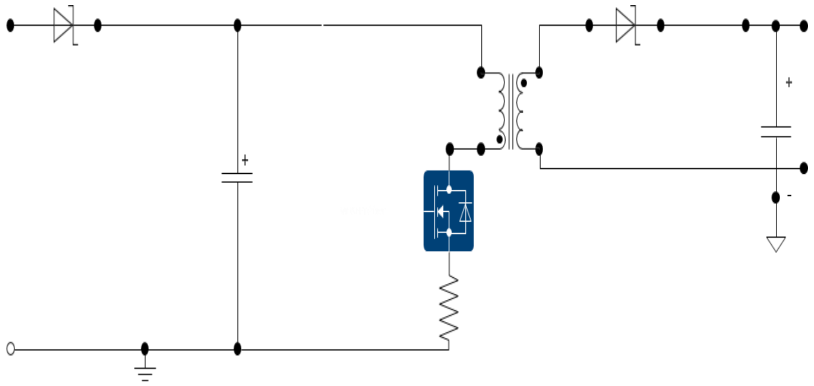
Design equations for MOSFET selection
$V_{DS} = V_{in} + VR$, where $VR = (0.8 * V_{out} * (NP / NS))$
$I_D = V_{in} * ton / L_p$
$V_{DS\_FET} = 1.5 * V_{DS}$ (with derating for all variables on board)
$R_{DS(on)}$ max. 25°C for acceptable power dissipation in MOSFET package $= (1.5 * P_{device}) / (I_{pk}^2 * D)$. I_{pk} is derated value of I_D to cover all worst case operation conditions. $I_{pk} = 1.5 * I_D$
$P_{device} = (T_j - T_a) / R_{thJA}$

Output power [W]	Output voltage [V]	inductance DCM [uH]	inductance CCM [uH]	SEMIHOW Device	
				DCM	CCM
120	19	71	143	HCx65R600T	HCx65R600T
100	24	107	214	HCx65R600T	HCx70R950T
75	19	107	214	HCx65R600T	HCx70R950T
50	12	107	214	HCx65R600T	HCx70R950T

APPLICATION

• Wide input range flyback topologies

LED drivers and adaptors

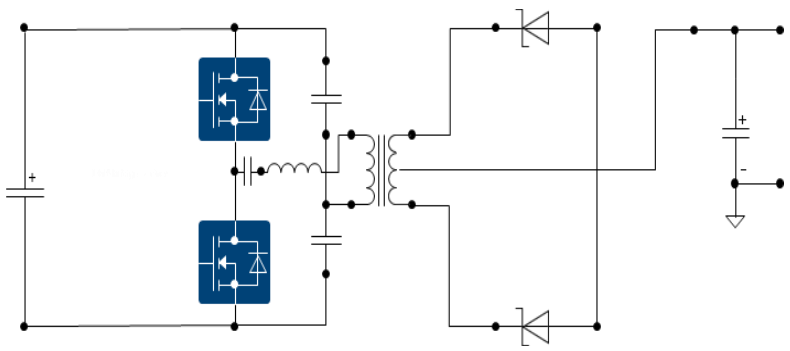


Design equations for MOSFET selection
$V_{DS} = V_{in} + VR$, where $VR = (0.8 * V_{out} * (NP / NS))$
$I_D = V_{in} * ton / L_p$
$V_{DS\_FET} = 1.5 * V_{DS}$ (with derating for all variables on board)
$R_{DS(on)}$ max. 25°C for acceptable power dissipation in MOSFET pack- age = $(1.5 * P_{device}) / (I_{pk}^2 * D)$. I_{pk} is derated value of I_D to cover all worst case operation conditions. $I_{pk} = 1.5 * I_D$
$P_{device} = (T_j - T_a) / R_{thJA}$

Output power [W]	Output voltage [V]	Primary inductance DCM [uH]	Primary inductance CCM [uH]	SEMIHOW Device	
				DCM	CCM
150	24	71	143	HCS80R380R	HCS80R500R
100	24	107	214	HCS80R380R	HCS80R650E
50	12	107	214	HCS80R380R	HCS80R650E
36	12	143	286	HCS80R500E	HCS80R650E
25	9	143	286	HCS80R500E	HCS80R650E
15	5	143	286	HCS80R500E	HCS80R650E
10	5	214	429	HCS80R650E	HCS80R1K4E
5	5	429	857	HCS80R1K4E	HCS80R1K4E

• Two switch topologies – half-bridge LLC

PC power and TV power supplies



Design equations for MOSFET selection
$V_{DS} = V_{in}$
$I_D = I_{out} * (NS / NP)$
$V_{DS\_FET} = 1.5 * V_{DS}$ (with derating for all variables on board)
$R_{DS(on)}$ max. 25°C for acceptable power dissipation in MOSFET package = $(1.5 * P_{device}) / (I_{pk}^2 * D)$. I_{pk} is derated value of I_D to cover all worst case operation conditions

Input voltage V_{DC} [V]	Output power [W]	Output voltage [V]	SEMIHOW Device
400	250	24	HCx60R350T/HCx60R380
400	200	24	HCx60R350T/HCx60R380
400	150	24	HCx60R520T
400	100	24	HCx60R700T
400	75	24	HCx60R700T

600V SUPER JUMCTION

RDS(on) MAX [mΩ]	TO-220F WIDE PITCH	TO-220F NORMAL	TO-252 (DPAK)	TO-251 (IPAK)	TO-247
92	HCS60R092EW	HCS60R092E			HCA60R092E
95	HCS60R092TW	HCS60R092T			HCA60R095T
150	HCS60R150TW	HCS60R150T			HCA60R150T
180	HCS60R180EW	HCS60R180E			
350	HCS60R350TW	HCS60R350T	HCD60R350T	HCU60R350T	
380	HCS60R380W	HCS60R380	HCD60R380	HCU60R380	
520	HCS60R520TW	HCS60R520T	HCD60R520T	HCU60R520T	
700	HCS60R700TW	HCS60R700T	HCD60R700T	HCU60R700T	

650V SUPER JUMCTION

RDS(on) MAX [mΩ]	TO-220F WIDE PITCH	TO-220F NORMAL	TO-252 (DPAK)	TO-251 (IPAK)	TO-247
42					HCA65R042E
69					HCA65R069E
110		HCS65R110E			HCA65R110E
125					HCA65R125E
160	HCS65R160TW	HCS65R160T			HCA65R160T
220		HCS65R220E			
380	HCS65R380TW	HCS65R380T	HCD65R380T	HCU65R380T	
420	HCS65R420W	HCS65R420	HCD65R420	HCU65R420	
600	HCS65R600TW	HCS65R600T	HCD65R600T	HCU65R600T	

700V SUPER JUMCTION

RDS(on) MAX [mΩ]	TO-220F	TO-262 (I2-PAK)	TO-252 (DPAK)	TO-251 (IPAK)	SOT-223
350	HCS70R350E		HCD70R350E		
500	HCS70R500E		HCD70R500E	HCU70R500E	
700	HCS70R700T	HCI70R700T	HCD70R700T	HCU70R700T	
950	HCS70R950T		HCD70R950T	HCU70R950T	
1400	HCS70R1K4P		HCD70R1K4P	HCU70R1K4P	
1500	HCS70R1K5E			HCU70R1K5E	
1600	HCS60R1K6			HCU70R1K6	HCT70R1K6

800V SUPER JUMCTION

RDS(on) MAX [mΩ]	TO-220F	TO-262 (I2-PAK)	TO-252 (DPAK)	TO-251 (IPAK)	SOT-223
250	HCS80R250T				
380	HCS80R380R				
500	HCS80R500R				
650	HCS80R650E		HCD80R650E		
1400	HCS80R1K4E		HCD80R1K4E	HCU80R1K4E	

600V CROSS REFERENCE

SEMIHOW	INFINEON	Fairchild	STM		Toshiba	AOS	Vishay	MAGNACHIP	NCE	Silikron	Lonten
HCS60R700T	IPA60R800CE		STF9NM60N	STF9N60M2	TK6A60W			MMF60R750PTH		SSF10N60F	
HCS60R520T	IPA60R650CE	FCPF600N60Z	STF10NM60N	STF10N60M2	TK7A60W	AOTF7S60	SiHF7N60E	MMF60R580PTH	NCE60R540F	SSF7NS60F	LSD07N60
HCS60R380	IPA60R460CE			STF12N60M2	TK8A60W	AOTF11S60					
HCS60R350T	IPA60R400CE	FCPF380N60	STF13NM60N	STF13N60M2	TK10A60W		SiHF12N60E	MMF60R360PTH	NCE60R360F	SSF11NS60F	LSD11N60F
HCD60R700T	IPD60R800CE		STD9NM60N	STD9N60M2	TK6P60W						
HCD60R520T	IPD60R650CE	FCD600N60Z	STD10NM60N	STD10N60M2	TK7P60W	AOD7S60	SiHD7N60E	MMD60R580PRH	NCE60R540K	SSF7NS60D	LSG07N60
HCD60R380	IPD60R460CE			STD12N60M2	TK8P60W						
HCD60R350T	IPD60R400CE		STD13NM60N	STD13N60M2	TK10P60W	AOD11S60		MMD60R360PRH	NCE60R360K	SSF11NS60D	LSG11N60
HCU60R700T	IPS60R800CE				TK6Q60W						
HCU60R520T	IPS60R650CE				TK7Q60W		SiHU7N60E				
HCU60R380	IPS60R460CE				TK8Q60W						
HCU60R350T	IPS60R400CE				TK10Q60W	AOI11S60					

650V CROSS REFERENCE

SEMIHOW	INFINEON	STM		Toshiba	AOS	Vishay	NCE	Silikron	Lonten
HCS65R600T	IPA65R650CE		STF11N65M2	TK8A65W		SiHF6N65E	NCE70R540F		LSD07N65
HCS65R380T HCS65R420	IPA65R400CE	STF15NM65N	STF16N65M2	TK11A65W	AOTF11S65	SiHF12N65E	NCE65R360F	SSSF11NS65UF	LSD11N65F
HCD65R600T	IPD65R650CE		STD11N65M2	TK8P65W	AOD7S65	SiHD6N65E	NCE70R540K		LSG07N65
HCD65R380T HCD65R420	IPD65R400CE	STD11NM65N	STD16N65M2	TK11P65W			NCE65R360K		LSG11N65F
HCU65R600T	IPS65R650CE		STU11N65M2	TK8Q65W	AOI7S65	SiHU6N65E	NCE65R540I	SSF7NS65G	LSH07N65
HCU65R380T HCU65R420	IPS65R400CE		STU16N65M2	TK11Q65W					LSH11N65F

700V CROSS REFERENCE

SEMIHOW	INFINEON		MAGNACHIP	NCE	Silikron	Lonten	TAIWAN SEMI	UTC
HCT70R1K6	IPN70R1K5CE		MMHS70R1K4P					5NM70G-AA2
HCD70R2K4T	IPD70R2K0CE			NCE70R2K2K				
HCU70R1K4P HCU70R1K5E HCU70R1K6	IPD70R1K4CE		MMD70R1K4PRH	NCE70R1K2K	SSF5NS70D		TSM70N1R4CP	5NM70G-TMS
HCD70T950T	IPD70R950CE		MMD70R900PRH	NCE70R900K		LSG04N70	TSM70N900CP	7NM70G-TMS
HCD70R700T	IPD70R600CE		MMD70R600PRH	NCE70R540K		LSG07N70	TSM70N600CP	
HCU70R2K4T	IPS70R2K0CE	IPSA70R2K0CE		NCE70R2K2I	SSF6N70G			
HCU70R1K4P HCU70R1K5E HCU70R1K6	IPS70R1K4CE	IPSA70R1K4CE	MMIS70R1K4PTH	NCE70R1K2I	SSF5NS70G		TSM70N1R4CH	
HCU70R950T	IPS70R950CE	IPSA70R950CE	MMIS70R900PTH	NCE70R900I	SSF7NS70UG	LSH04N70	TSM70N900CH	
HCU70R700T	IPS70R600CE	IPSA70R600CE		NCE70R540I		LSH07N70	TSM70N600CH	
HCI70R950T	IPI70R950CE					LSF04N70		

800V CROSS REFERENCE

SEMIHOW	INFINEON	Fairchild	STM		Toshiba	MagnaChip	NCE	TAIWAN SEMI	Toshiba	STMicroelectronics
HCS80R1K4E	IPA80R1K4CE	FCPF1300N80Z		STF6N80K5					TK10A80E	STP7NK80ZFP
HCS80R650E	IPA80R650CE	FCPF650N80Z		STF10N80K5	TK10A80W	MMF80R650PTH				
HCS80R500R	IPA80R460CE	FCPF400N80Z	STF11NM80	STF13N80K5	TK12A80W	MMF80R450PTH				
HCS80R380R	IPA80R310CE	FCPF290N80	STF18NM80	STF23N80K5	TK17A80W					
HCD80R1K4E	IPD80R1K4CE	FCD1300N80Z		STD6N80K5						
HCU80R1K4E	IPU80R1K4CE									

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