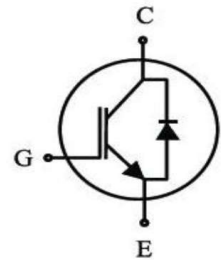
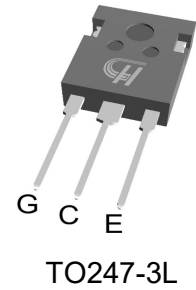


650V, 60A Trench Field Stop IGBT
Features

- * $V_{CE}=650V$, $I_C = 60A$
 $V_{CE(sat)}=1.85V$, $I_C=60A$,
- * High breakdown voltage to 650V for improved reliability
- * Super junction Technology Offering:
 - High speed switching
 - High ruggedness, temperature stable behavior
 - Low V_{CEsat}
 - Easy Parallel Switching Capability Due to Positive Temperature Coefficient in V_{CEsat}
- * Enhanced avalanche capability
- * TO247-3L Package

Applications

- * Uninterruptible Power Supply (UPS)
- * Welding Converters & Inverter
- * Power Factor Correnction (PFC)
- * Coverter with high switching frequency

Pin Description and Schematic

Trench Field Stop IGBT
Package Marking And Ordering Information

Device	Marking ^[1]	Device Package	Quantity
HCR60T65GT247BP	HCR60T65G xx	TO247-3L	1800pcs/Box

note 1. The 'HCR60T65G' is product type and the 'xx' is date code.

ABSOLUTE MAXIMUM RATINGS (TC = 25°C UNLESS OTHERWISE NOTED)

Parameter	Symbol	HCR60T65G	Unit
Collector-Emitter Breakdown Voltage	V_{CE}	650	V
DC Collector Current, Limited by T_{JMAX}	I_C	$T_C=25^{\circ}C$ 120	A
		$T_C=100^{\circ}C$ 60	
Diode Forward Current, Limited by T_{JMAX}	I_F	$T_C=25^{\circ}C$ 120	A
		$T_C=100^{\circ}C$ 60	
Continuous Gate-emitter Voltage	V_{GE}	± 20	V
Transient Gate-emitter Voltage	V_{GE}	± 30	V
Turn off safe Operating area $V_{CE} \leq 650V$, $T_J \leq 150^{\circ}C$	-	180	A
Pulsed Collector Current, $V_{GE}=15V$, t_P limited by T_{JMAX}	I_{CM}	180	A
Power Dissipation, $T_J=25^{\circ}C$	P_{tot}	260	W
Soldering temperature, wave soldering 1.6mm(0.063in.) from case for 10s	T_L	260	$^{\circ}C$
Operating Junction Temperature Range	T_J	-40 to 150	$^{\circ}C$
Storage Temperature Range	T_{stg}	-55 to 150	$^{\circ}C$
IGBT Thermal Resistance, Junction-Case	R_{QJC}	0.48	K/W
FRD Thermal Resistance, Junction-Case	R_{QJC}	1.1	K/W
Thermal Resistance, Junction-to-Ambient(Maximum)	R_{QJA}	40.0	K/W

650V, 60A Trench Field Stop IGBT
Electrical Characteristics (TA = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	HCR60T65G			Unit
			Min	Typ	Max	
States						
Collector-Emitter Breakdown Voltage	BV _{CES}	V _{GE} 0V, I _C =250uA	650	-	-	V
Gate-Threshold Voltage	V _{GE(th)}	V _{GE} =V _C E, I _C =250uA	4.0	5.0	6.0	V
Collector-Emitter Saturation Voltage	V _C E(sat)	V _{GE} =15V, I _C =60A, T _J =25'C	-	1.85	2.2	V
		V _{GE} =15V, I _C =60A, T _J =150'C	-	2.25	-	V
Zero Gate Voltage Collector Current	I _C ES	V _C E=650V, V _{GE} =0V, T _J =25'C	-	1	40	uA
		V _C E=650V, V _{GE} =0V, T _J =150'C	-	-	1000	uA
Gate-Emitter Leakage Current	I _G ES	V _C E=0V, V _{GE} =±20V	-	-	100	nA
Transconductance	g _{fs}	V _C E= 20V, I _C = 60A	-	52	-	S
Dynamic						
Input Capacitance	C _I ES	V _C E= 30V, V _{GE} = 0V F=1MHz	-	3800	-	pF
Onput Capacitance	C _O ES		-	130	-	
Reverse Transfer Capacitance	C _R ES		-	70	-	
Gate Charge	Q _g	V _{CC} =520V,I _C =60A, V _{GE} = 15V	-	158	-	nC
Turn-On Delay Time	t _{d(on)}	T _J =25'C, V _C E=400V,I _C =60A, V _{GE} =0.0/15V, R _G =12Ω note1	-	56	-	ns
Rise Time	t _r		-	79	-	
Turn-Off Delay Time	t _{d(off)}		-	165	-	
Fall Time	t _f		-	81	-	
Turn-on Energy	E _{ON}		-	2.2	-	mJ
Turn-off Energy	E _{OFF}		-	0.89	-	
Dynamic						
Diode Forward Voltage	V _{FM}	I _F =60A	-	2.9	-	V
Reverse Recovery Time	t _{rr}	I _F =40A, V _R =300V, di/dt=600A/us	-	90	-	ns
Reverse Recovery Current	I _{rr}		-	17	-	A
Reverse Recovery Charge	Q _{rr}		-	900	-	nC

650V, 60A Trench Field Stop IGBT

Typical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

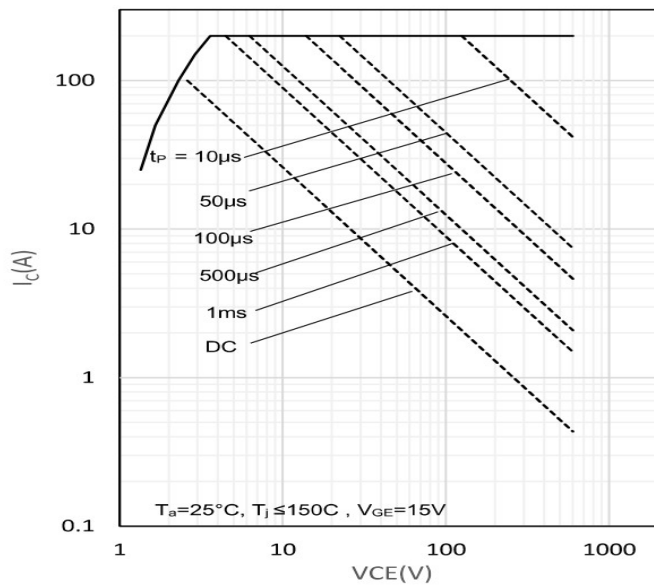


Figure 1. FBSOA characteristics

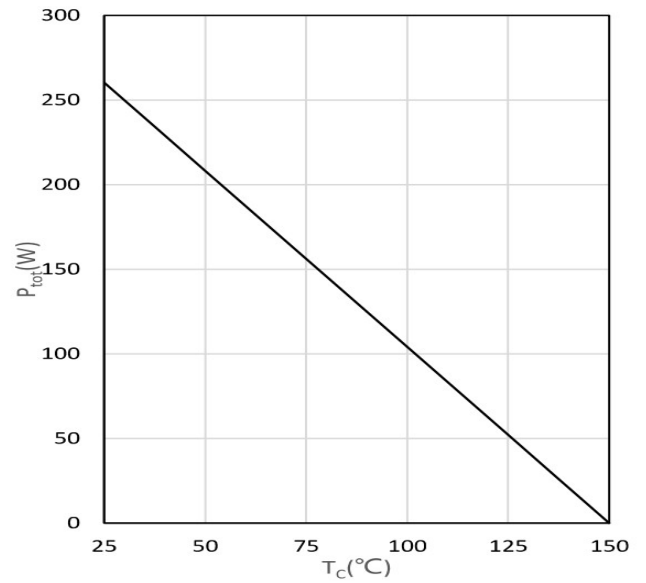


Figure 2. Power dissipation as a function of TC

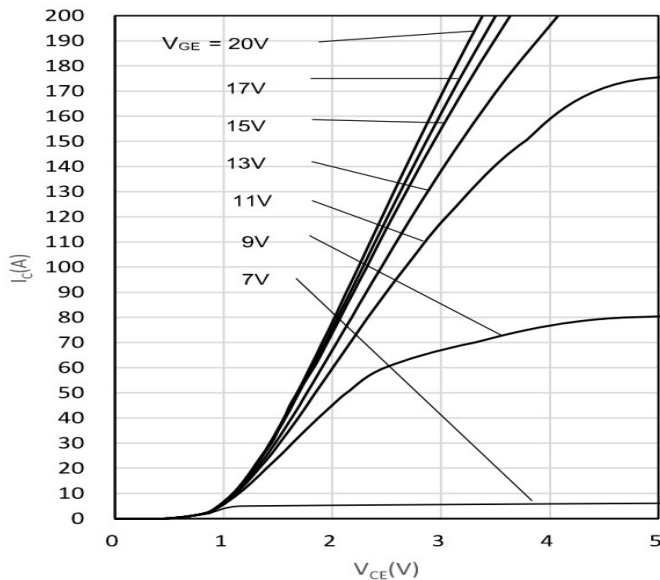


Figure 3. Output characteristics

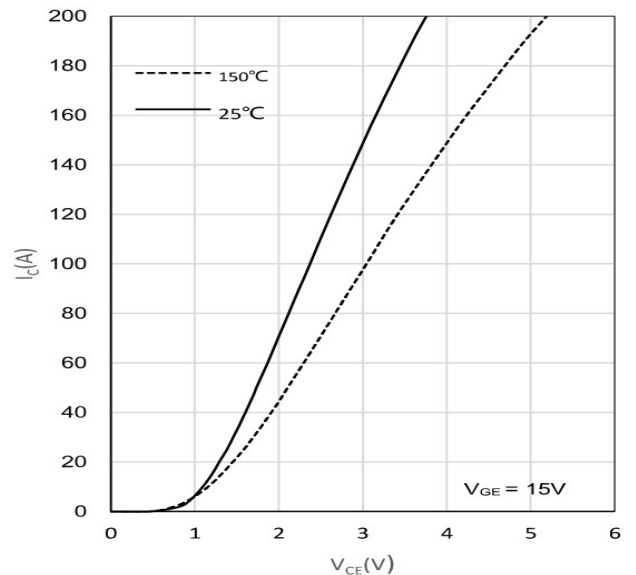


Figure 4. Saturation voltage characteristics

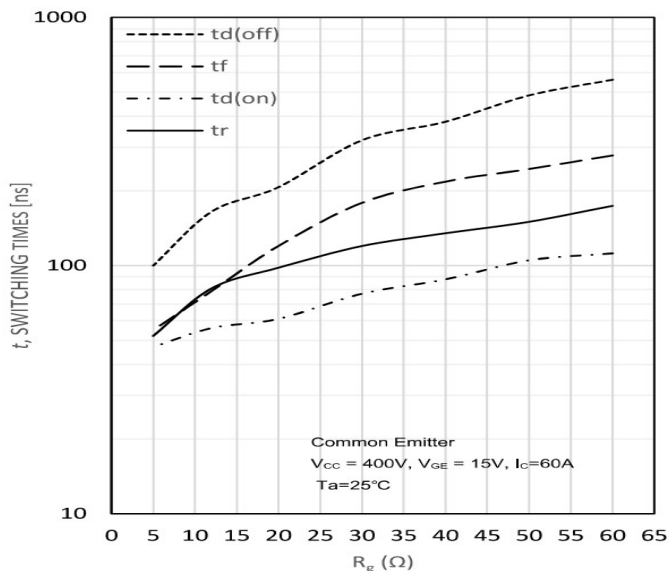


Figure 5. Switching times vs. gate resistor

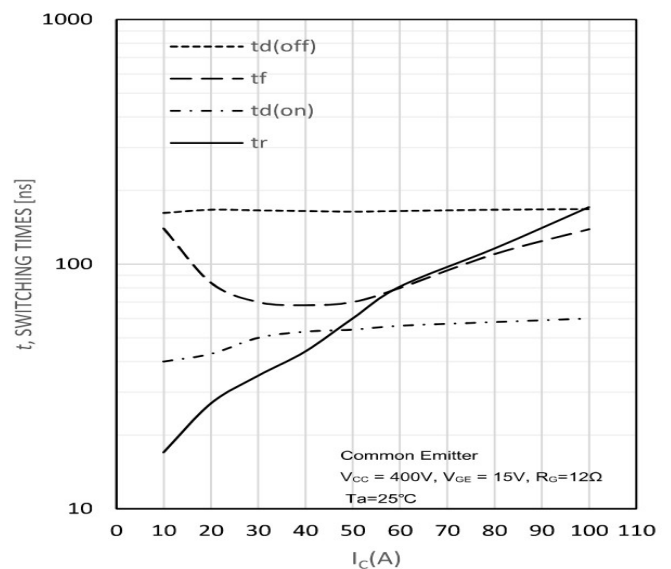


Figure 6. Switching times vs. collector current

650V, 60A Trench Field Stop IGBT

Typical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted) (con.)

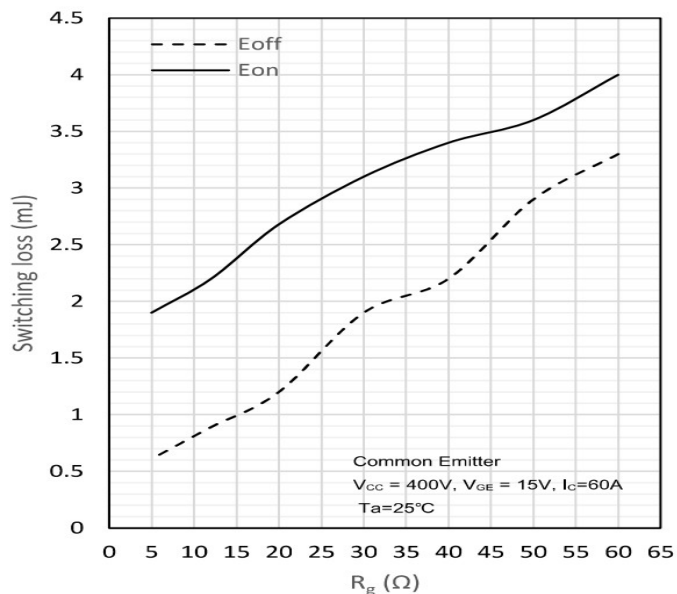


Figure 7. Switching loss vs. gate resistor

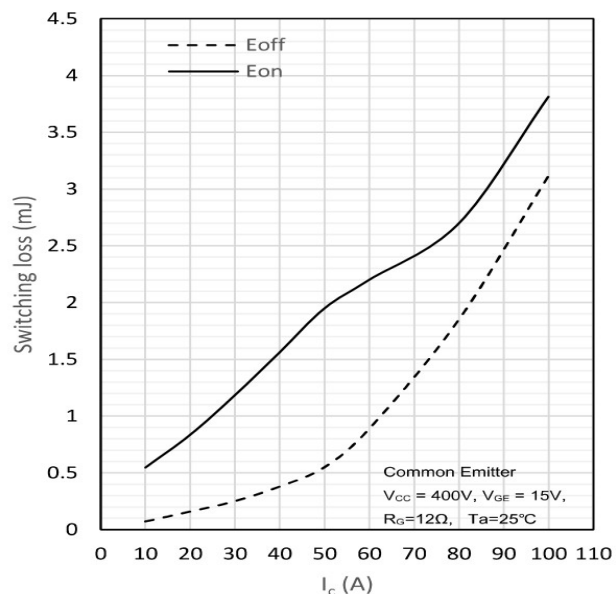


Figure 8. Switching loss vs. collector current

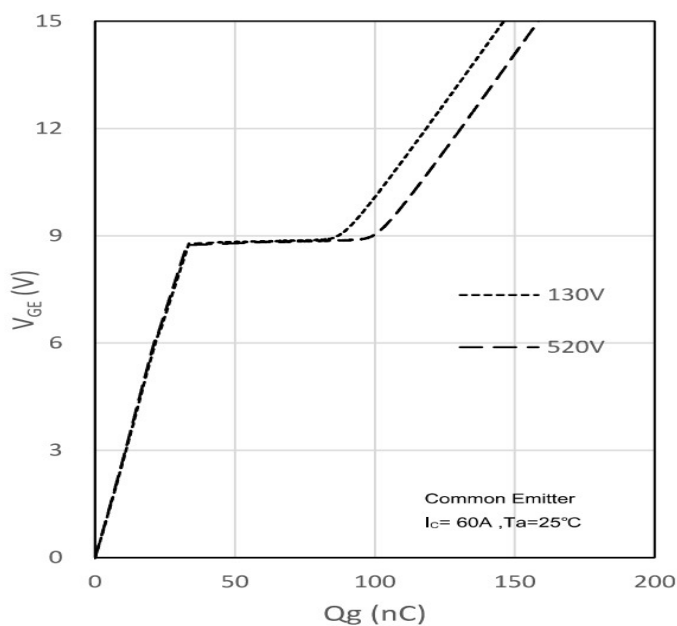


Figure 9. Gate charge characteristics

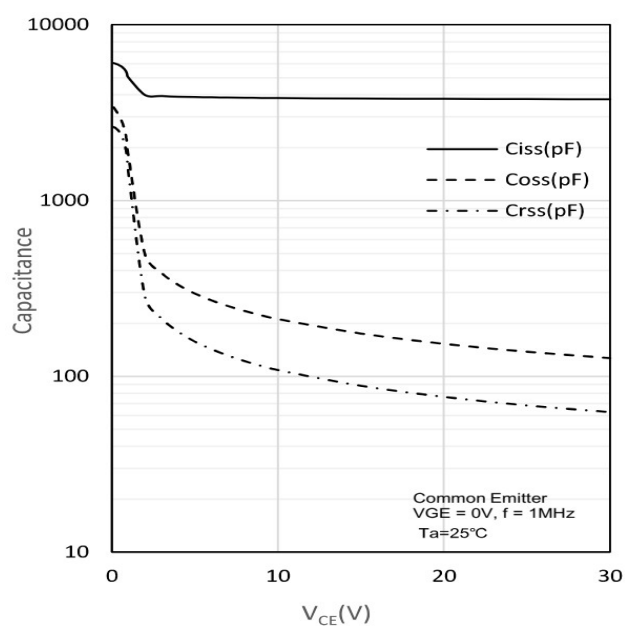
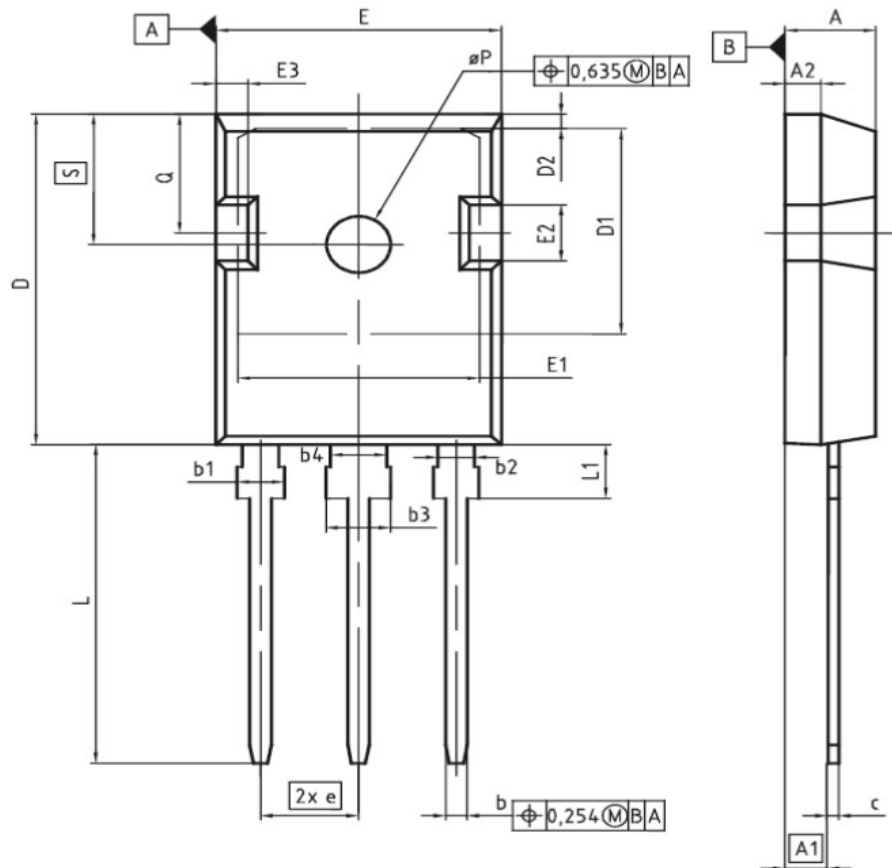


Figure 10. Capacitance characteristics

650V, 60A Trench Field Stop IGBT
Packaging Information

PKG: TO247-3L Package

unit : mm



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	2.60	0.039	0.102
e	5.44 (BSC)		0.214 (BSC)	
N	3		3	
L	19.80	20.32	0.780	0.800
L1	4.10	4.47	0.161	0.176
ØP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248